



ConnectX® IB Dual Port InfiniBand Adapter Card User's Manual

P/N: MHEH28-XSC, MHEH28-XTC, MHGH28-XSC, MHGH28-XTC,
MHGH29-XSC, MHGH29-XTC, MHJH29-XSC, MHJH29-XTC

Rev 1.2

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ConnectX IB Dual Port InfiniBand[®]

Document Number: 2802

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Revision History

This document was printed on August 6, 2008 10:52 am.

Table 1 - Revision History Table

Date	Rev	Comments/Changes
August 2008	1.2	Removed watermark
May 2008	0.31	Added CTUVUS and CB report status to Cert Table in Appendix A.
April 2008	0.30	Preliminary release <i>User's Manual for ConnectX IB Adapter Cards</i> Added C-tick and Mic for relevant cards Changed OFED link to Mellanox OFED Removed Confidential

About this Manual

This *User's Manual* describes Mellanox Technologies ConnectX IB PCI Express x8 HCA Adapter cards. It provides details as to the interfaces of the board, specifications, required software and firmware for operating the board, and relevant documentation.

Intended Audience

This manual is intended for the installer and user of these cards.

The manual assumes basic familiarity with Infiniband™ networks and architecture specifications.

Related Documentation

Table 2 - Documents List

<i>Mellanox Firmware Tools (MFT) User's Manual</i> Document no. 2204UG	User's Manual describing the set of MFT firmware management tools for a single InfiniBand node. See http://www.mellanox.com under 'Firmware' downloads.
<i>Mellanox MST User's Manual</i> Document no. 2125SM	This manual describes various tools and utilities, included in the Mellanox Software Tools (MST) package, for accessing, burning firmware, and tracing Mellanox silicon devices.
<i>InfiniBand Administration (IBADM) Package User's Manual</i> Document no. 2130UM	User's Manual describing the utilities included in the IBADM tools package for system administration of an InfiniBand cluster. See http://www.mellanox.com under 'Management Tools'.
<i>IB Specifications Release 1.0.a</i>	Infiniband Architecture Specifications
<i>PCI Express 2.0 Specifications</i>	Industry Standard PCI Express 2.0 Card Electromechanical Specification, Rev 1.3.

Online Resources

- Mellanox Technologies Web pages: <http://www.mellanox.com>
- Mellanox Technologies Firmware download Web page: <http://www.mellanox.com/> under Firmware downloads
- Mellanox Technologies Document Distribution System (DDS): <http://docs.mellanox.com> (requires a customer login account)

Document Conventions

When discussing memory sizes, MB and MBytes are used in this document to mean size in mega bytes. The use of Mb or Mbits (small b) indicates size in mega bits.

1 Overview

This document is a *User's Manual* for Mellanox Technologies host channel adapter (HCA) Cards based on the MT25408 ConnectX® IB integrated circuit device. The cards described in this manual have the following main features:

- IBTA v1.2 compliant
- Two 4X InfiniBand CX4 copper ports for connecting InfiniBand traffic (4X IB connectors)
- PCI Express 2.0 (1.1 compatible) through an x8 edge connector up to 5GT/s
- 'Media detect circuit' with powered connectors supporting the use of active cables and external PHY fiber solutions
- EU Restriction of Hazardous Substances (RoHS) compliant
- SDR/DDR/QDR: IB10Gb/s (SDR) or 20Gb/s (DDR) or 40Gb/s (DDR)
- Two bracket heights: short or tall

1.1 Adapter Cards

- Table 3 lists the InfiniBand HCA cards described in this manual.

Table 3 - HCA Cards

Ordering Part Number (OPN)	PCI Express SERDES Speed	IB SDR / DDR	Short / Tall Bracket	RoHS Compliance	HCA IC Part Number	HCA Card Photo ⁽¹⁾
MHEH28-XSC	2.5 GT/s	SDR	Short	RoHS-R5 (with exemption)	MT25408A0-FCC-SI	Figure 1: HCA Card
MHEH28-XTC	2.5 GT/s		Tall			
MHGH28-XSC	2.5 GT/s	DDR	Short	RoHS-R5 (with exemption)	MT25408A0-FCC-DI	
MHGH28-XTC	2.5 GT/s		Tall			
MHGH29-XSC	5.0 GT/s	DDR	Tall	RoHS-R5 (with exemption)	MT25408A0-FCC-GI	
MHGH29-XSC	5.0 GT/s		Tall			
MHJH29-XSC	5.0 GT/s	QDR	Tall	RoHS-R5 (with exemption)	MT25408A0-FCC-JI	Short Bracket (-XSC)
MHJH29-XTC	5.0 GT/s		Tall			

1. The HCA cards have a similar form and fit. The main visible difference is in the bracket height.

1.2 Mellanox Part Numbering Legend

Table 4 describes the Mellanox Technologies adapter cards part numbering legend.

Table 4 - Mellanox HCA Cards Part Numbering Key

HCA Card OPN MHTS#I-XBR	Field	Decoder
M	Mellanox Technologies	
H	Adapter Type	H = InfiniBand Host Channel Adapter, N = Ethernet Network Interface Card, S = Express Module
T	Media	E=CX4 SDR, G=CX4 DDR, J=CX4 QDR, K=XFP SR, M=SFP+ SR, N=SFP+ LRM, O=SFP+ LR, Q=QSFP QDR, R=QSFP DDR, T=UTP
S	Silicon	H = ConnectX, S = InfiniHost III Lx [®] , T= InfiniHost [®] , A= InfiniHost [®] III Ex
#	# ports	1 = 1, 2 = 2,
I	Host Interface	X = PCI-X, 4 = PCIe x4, 8 = PCIe x8, 9 = PCIe (SerDes @ 5.0 GT/s)
G	Generation	<blank> = Initial product generation
-	Separator	
X	Memory Size	X = MemFree, 1=128MB, 2=256MB, 3=512MB
B	Bracket	S = Short, T = Tall, N = None
R	RoHS	<blank> = non RoHS, C = RoHS w/ Exemption, R = RoHS Lead-Free

For example, the part number MHGH28-XSC describes Mellanox Technologies' ConnectX™ IB HCA card with dual CX4 ports, a PCIe2.0 x8 2.5GT/s interface, no on-board memory (mem-free), a short PCI bracket, and RoHS R5 compliance. Using the legend,

- field M = M to indicate a Mellanox Technologies product,
- field H = H to indicate an InfiniBand Adapter Card,
- field T = G to indicate CX4 DDR,
- field S = H to indicate the ConnectX family,
- field # = 2 to indicate two ports,
- field I = 8 to indicate PCI Express 2.0 x8 running at 2.5GT/s,
- field X = X to indicate no on-board memory,
- field B = S to indicate a short bracket, and
- field R = C to indicate RoHS R5 (w/ Exemptions) compliance

1.3 Finding the GUID and Serial Number on the Adapter Cards

All mellanox HCA adapter cards have a label on the printed side of the adapter card that has the card serial number and the card GUID.



2 HCA Card Installation

2.1 Hardware and Software Requirements

Before installing the HCA Adapter card, please make sure that the system meets the hardware and software requirements listed in Table 5.

Table 5 - Hardware and Software Requirements

Requirement	Description
Hardware	PCI Express x8 or x16 slots
Software Operating Systems/Distributions	<ul style="list-style-type: none"> For Windows see WinIB ReadMe at https://docs.mellanox.com/dm/WinIB/ReadMe.html For Linux see Mellanox OpenFabrics Enterprise Distribution (OFED) software package available via the Mellanox OpenFabrics Web site http://www.mellanox.com/products/ofed.php

2.2 Installation Instructions

Read all installation instructions before connecting the equipment to the power source.

2.2.1 Installation Safety Warnings

1. Installation Instructions

Read all installation instructions before connecting the equipment to the power source.



2. Over-temperature

This equipment should not be operated in an area with an ambient temperature exceeding the maximum recommended 5°C (°F). Moreover, to guarantee proper air flow, allow at least 8cm (3 inches) of clearance around the ventilation openings.



3. During Lightning - Electrical Hazard

During periods of lightning activity, do not work on the equipment or connect or disconnect cables.



4. Copper InfiniBand Cable Connecting/Disconnecting

Copper InfiniBand cables are heavy and not flexible, as such they should be carefully attached to or detached from the connectors. Refer to the cable manufacturer for special warnings and instructions.



5. Equipment Installation



This equipment should be installed, replaced, or serviced only by trained and qualified personnel.

6. Equipment Disposal



Disposal of this equipment should be in accordance to all national laws and regulations.

7. Local and National Electrical Codes



This equipment should be installed in compliance with local and national electrical codes.

2.2.2 Installation Instructions

The adapter cards listed in Table 3 on page 8 are standard PCI Express 8 cards each with a standard x8 edge connector. Please consult the host machine documentation for instructions on how to install a PCI Express card.

3Driver Software and Firmware

3.1 Driver Software

For Linux, download and install the latest OpenFabrics Enterprise Distribution (OFED) software package available via the Mellanox OpenFabrics Web site at <http://www.mellanox.com/products/ofed.php>. Follow the installation instructions included in the download package.

For Windows, download the appropriate software from <https://docs.mellanox.com/dm/WinIB/ReadMe.html>.

3.2 Updating HCA Card Firmware

Each HCA card is shipped with the latest version of qualified firmware at the time of manufacturing. Firmware is updated occasionally, and the most recent firmware can be obtained from <http://www.mellanox.com> through the 'Firmware' downloads link.

3.3 Single HCA Card Firmware Update

Firmware can be updated on the standalone single card using the **flint** tool of the *Mellanox Firmware Tools (MFT)* package. This package is available for download, along with its user's manual, from the single HCA card firmware update page. See <http://www.mellanox.com> under 'Firmware' downloads.

A firmware binaries table lists a binary file per HCA card. The file name of each such binary is composed by combining the firmware name, the firmware release version, and the card part number. Please contact your assigned Field Application Engineer if you cannot find the firmware binary for your adapter card. This may happen if the product is not yet available for general distribution.

3.4 HCA Card Firmware Update as Part of a Cluster Firmware Update

If the HCA card is part of an InfiniBand cluster, its firmware can be updated as part of the entire cluster firmware update¹, using the **ibfwmgr** tool of the IB administration (IBADM) tools package. IBADM is available for download from <http://www.mellanox.com>, through the Management Tools download link. Check the 'Firmware' downloads link for cluster update instructions.

1. Currently, only the Linux distributions support updating firmware for an entire InfiniBand cluster.

4Adapter Card Interfaces

4.1 I/O Interfaces

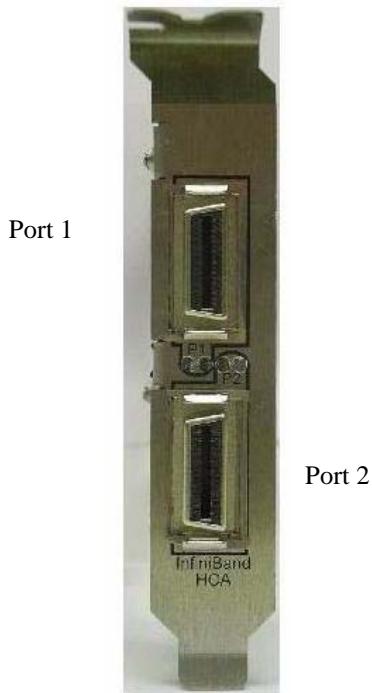
Each HCA card includes the following interfaces:

- Two 4X InfiniBand Copper Connectors
- PCI Express x8 edge connector
- I/O panel LEDs
- I²C compatible connector (for debug)

4.1.1 InfiniBand Interface

The ConnectX®IB (MT25408) device is compliant with the *InfiniBand Architecture Specification, Release 1.2*. It has two compliant 4X InfiniBand ports, 1 and 2, each having four Tx/Rx pairs of SerDes. Each of the HCA cards (listed in Table 3 on page 8) based on this device provides access to these ports by means of two InfiniBand connectors. These cards are also compliant with the IBTA specification 1.2. Connector 1 connects to port 1 of the device, while connector 2 connects to port 2.

Figure 2: Port Numbering



Each of the HCA cards is embedded with a ‘media detect circuit’ that supports active cables and external InfiniBand fiber solutions to be connected to the InfiniBand port connectors. Fiber Solutions require the use of active media converters.

The cards can be either a master initiating the PCI Express bus operations or a slave responding to PCI bus operations.

4.1.2 LED Assignment

The board has four LEDs located on the I/O panel - 2 LEDs per port. The green LED, when lit, indicates that the InfiniBand driver is running and a valid physical connection between nodes exists. The yellow LED when lit, indicates a valid data activity link, this is the logical link. The yellow LED illuminates when the InfiniBand network is discovered over the physical link. A valid data activity link without data transfer is designated by a constant yellow LED indication. A valid data activity link with data transfer is designated by a blinking yellow LED indication. If the LEDs are not active, either the physical link or the logical link (or both) connections have not been established.

Figure 3: Physical and Logical Link Indications

Table 6 - LEDs

Port Number	LED Name
Port 1	Physical Link - Green Constant on indicates a good physical link Blinking indicates a problem with the Physical link
	Data Activity - Yellow Blinking indicates Data Transfer Constant on indicates no Data Transfer
Port 2	Physical Link - Green Constant on indicates a good physical link Blinking indicates a problem with the Physical link
	Data Activity - Yellow Blinking indicates Data Transfer Constant on indicates no Data Transfer



Port 2

Note: The short bracket has the same port and LED footprint as the tall bracket.

4.2 I²C Compatible Interface

A three-pin header on the HCA card is provided as the I²C compatible interface. See Figure 6 on page 26 for the location on the board.

Figure 4: I²C Connector



4.3 Power

All adapter cards receive power from the PCI Express Edge connector. All other required power voltages are generated by on-board switch mode regulators. See "Specifications" on page 26.

4.4 Memory

The HCA cards support multiple memory devices through the PCI Express, Flash, and I2C-compatible interfaces.

4.4.1 System Memory

Each of the HCA cards utilizes the PCI Express interface to store and access IB fabric connection information and packet data on the system memory.

4.4.2 Flash

Each of the HCA cards includes one 2MB SPI Flash device (M25P80 device by ST Microelectronics) accessible via the Flash interface of the MT25408 ConnectX IB device.

There is a jumper on each adapter card that indicates to the device whether an on-board Flash device exists (or is to be used). Table 7 provides information on this jumper. See Figure 6 on page 26 for the jumper location.

Table 7 - Jumper Configuration

Description	Option	Card Default Configuration	Comments
Flash present/ not present	connection open – Flash present connection shorted – Flash not present Figure 5: Flash Jumper 	connection open – Flash present	Header 1x2

4.4.3 EEPROM

Each board incorporates an EEPROM that is accessible through the I2C-compatible interface. The EEPROM is used for storing the Vital Product Data (VPD). The VPD format adheres to the *PCI Local Bus specification rev 2.3* VPD definition. The EEPROM capacity is 512 bytes.

4.5 VPDs

The PCI VPD (Vital Product Data) layout, for each of the described Mellanox Technologies[®] ConnectX IB HCA adapter cards, complies with the format defined in the *PCI 2.3 Specification, Appendix I*. All ConnectX IB HCA adapter cards share the same PCI VPD layout.“A1” was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 8 - VPD Layout for MHEH28-XSC

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length [7:0] LSB	0x9		
2	Length [15:8] MSB	0x0		
3	Data	Eagle SDR	STR	
12	Large Resource Type VPD-R Tag (0x10)	0x90		
13	Length [7:0] LSB	0x4F		
14	Length [15:8] MSB	0x00		
15	VPD Keyword	PN	STR	Add in Card Part Number
17	Length	0x15		
18	PN	MHEH28-XSC	%STR_SPC	
39	VPD Keyword	EC	STR	Engineering Change Level of the card (rev)
41	Length	0x2		
42	Revision	A1	%STR	PCB revision
44	VPD Keyword	SN	STR	Serial Number
46	Length	0x18		
47	Serial Number		%STR_SPC	“00..00XXXX..XX”
71	VPD Keyword	V0	STR	Misc. Information
73	Length	0x10		
74	Data	PCIe x8	STR_SPC	
90	VPD Keyword	RV	STR	
92	Length	0x1		
93	Data	0,92	%CS0	
94	Large Resource Type VPD-W Tag (0x11)	0x91		
95	Length [7:0] LSB	0x9E		
96	Length [15:8] MSB	0x00		
97	VPD Keyword	V1	STR	EFI Driver version
99	Length	0x6		
100	Data	N/A	STR_SPC	
106	VPD Keyword	YA	STR	Asset Tag
108	Length	0x20		
109	Data	N/A	STR_SPC	“N/A”
141	VPD Keyword	RW	STR	Remaining read/write area
143	Length	0x6F		
144	Data		STR_ZERO	Reserved (0x00)
255	Small Resource Type END Tag (0x11)	0x78		

Note: “A1” was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format.

Table 9 - VPD Layout for MHEH28-XTC

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length [7:0] LSB	0x9		
2	Length [15:8] MSB	0x0		
3	Data	Eagle SDR	STR	
12	Large Resource Type VPD-R Tag (0x10)	0x90		
13	Length [7:0] LSB	0x4F		
14	Length [15:8] MSB	0x00		
15	VPD Keyword	PN	STR	Add in Card Part Number
17	Length	0x15		
18	PN	MHEH28-XTC	%STR_SPC	
39	VPD Keyword	EC	STR	Engineering Change Level of the card (rev)
41	Length	0x2		
42	Revision	A1	%STR	PCB revision
44	VPD Keyword	SN	STR	Serial Number
46	Length	0x18		
47	Serial Number		%STR_SPC	“00..00XXXX..XX”
71	VPD Keyword	V0	STR	Misc. Information
73	Length	0x10		
74	Data	PCIe x8	STR_SPC	
90	VPD Keyword	RV	STR	
92	Length	0x1		
93	Data	0,92	%CS0	
94	Large Resource Type VPD-W Tag (0x11)	0x91		
95	Length [7:0] LSB	0x9E		
96	Length [15:8] MSB	0x00		
97	VPD Keyword	V1	STR	EFI Driver version
99	Length	0x6		
100	Data	N/A	STR_SPC	
106	VPD Keyword	YA	STR	Asset Tag
108	Length	0x20		
109	Data	N/A	STR_SPC	“N/A”
141	VPD Keyword	RW	STR	Remaining read/write area
143	Length	0x6F		
144	Data		STR_ZERO	Reserved (0x00)
255	Small Resource Type END Tag (0x11)	0x78		

Note: “A1” was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format

Table 10 - VPD Layout for MHGH28-XSC

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length [7:0] LSB	0x9		
2	Length [15:8] MSB	0x0		
3	Data	Eagle SDR	STR	
12	Large Resource Type VPD-R Tag (0x10)	0x90		
13	Length [7:0] LSB	0x4F		
14	Length [15:8] MSB	0x00		
15	VPD Keyword	PN	STR	Add in Card Part Number
17	Length	0x15		
18	PN	MHGH28-XSC	%STR_SPC	
39	VPD Keyword	EC	STR	Engineering Change Level of the card (rev)
41	Length	0x2		
42	Revision	A1	%STR	PCB revision
44	VPD Keyword	SN	STR	Serial Number
46	Length	0x18		
47	Serial Number		%STR_SPC	“00..00XXXX..XX”
71	VPD Keyword	V0	STR	Misc. Information
73	Length	0x10		
74	Data	PCIe x8	STR_SPC	
90	VPD Keyword	RV	STR	
92	Length	0x1		
93	Data	0,92	%CS0	
94	Large Resource Type VPD-W Tag (0x11)	0x91		
95	Length [7:0] LSB	0x9E		
96	Length [15:8] MSB	0x00		
97	VPD Keyword	V1	STR	EFI Driver version
99	Length	0x6		
100	Data	N/A	STR_SPC	
106	VPD Keyword	YA	STR	Asset Tag
108	Length	0x20		
109	Data	N/A	STR_SPC	“N/A”
141	VPD Keyword	RW	STR	Remaining read/write area
143	Length	0x6F		
144	Data		STR_ZERO	Reserved (0x00)
255	Small Resource Type END Tag (0x11)	0x78		

Note: “A1” was used as the HCA card (PCB) revision. Later revisions of the HCA card will have the same format

Table 11 - VPD Layout for MHGH28-XTC

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length [7:0] LSB	0x9		
2	Length [15:8] MSB	0x0		
3	Data	Eagle SDR	STR	
12	Large Resource Type VPD-R Tag (0x10)	0x90		
13	Length [7:0] LSB	0x4F		
14	Length [15:8] MSB	0x00		
15	VPD Keyword	PN	STR	Add in Card Part Number
17	Length	0x15		
18	PN	MHGH28-XTC	%STR_SPC	
39	VPD Keyword	EC	STR	Engineering Change Level of the card (rev)
41	Length	0x2		
42	Revision	A1	%STR	PCB revision
44	VPD Keyword	SN	STR	Serial Number
46	Length	0x18		
47	Serial Number		%STR_SPC	“00..00XXXX..XX”
71	VPD Keyword	V0	STR	Misc. Information
73	Length	0x10		
74	Data	PCIe x8	STR_SPC	
90	VPD Keyword	RV	STR	
92	Length	0x1		
93	Data	0,92	%CS0	
94	Large Resource Type VPD-W Tag (0x11)	0x91		
95	Length [7:0] LSB	0x9E		
96	Length [15:8] MSB	0x00		
97	VPD Keyword	V1	STR	EFI Driver version
99	Length	0x6		
100	Data	N/A	STR_SPC	
106	VPD Keyword	YA	STR	Asset Tag
108	Length	0x20		
109	Data	N/A	STR_SPC	“N/A”
141	VPD Keyword	RW	STR	Remaining read/write area
143	Length	0x6F		
144	Data		STR_ZERO	Reserved (0x00)
255	Small Resource Type END Tag (0x11)	0x78		

Table 12 - VPD Layout for MHGH29-XSC

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length [7:0] LSB	0x9		
2	Length [15:8] MSB	0x0		
3	Data	Eagle DDR	STR	
12	Large Resource Type VPD-R Tag (0x10)	0x90		
13	Length [7:0] LSB	0x4F		
14	Length [15:8] MSB	0x00		
15	VPD Keyword	PN	STR	Add in Card Part Number
17	Length	0x15		
18	PN	PN	%STR_SPC	
39	VPD Keyword	EC	STR	Engineering Change Level of the card (rev)
41	Length	0x2		
42	Revision	A1	%STR	PCB revision
44	VPD Keyword	SN	STR	Serial Number
46	Length	0x18		
47	SerialNumber		%STR_SPC	“00..00XXXX..XX”
71	VPD Keyword	V0	STR	Misc. Information
73	Length	0x10		
74	Data	PCIe Gen2 x8	STR_SPC	
90	VPD Keyword	RV	STR	
92	Length	0x1		
93	Data	0,92	%CS0	
94	Large Resource Type VPD-W Tag (0x11)	0x91		
95	Length [7:0] LSB	0x9E		
96	Length [15:8] MSB	0x00		
97	VPD Keyword	V1	STR	EFI Driver version
99	Length	0x6		
100	Data	N/A	STR_SPC	
106	VPD Keyword	YA	STR	Asset Tag
108	Length	0x20		
109	Data	N/A	STR_SPC	“N/A”

Table 12 - VPD Layout for MHGH29-XSC

141	VPD Keyword	RW	STR	Remaining read/write area
143	Length	0x6F		
144	Data		STR_ZERO	Reserved (0x00)
255	Small Resource Type END Tag (0x11)	0x78		

Table 13 - VPD Layout for MHGH29-XTC

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length [7:0] LSB	0x9		
2	Length [15:8] MSB	0x0		
3	Data	Eagle DDR	STR	
12	Large Resource Type VPD-R Tag (0x10)	0x90		
13	Length [7:0] LSB	0x4F		
14	Length [15:8] MSB	0x00		
15	VPD Keyword	PN	STR	Add in Card Part Number
17	Length	0x15		
18	PN	MHGH29-XSC	%STR_SPC	
39	VPD Keyword	EC	STR	Engineering Change Level of the card (rev)
41	Length	0x2		
42	Revision	A1	%STR	PCB revision
44	VPD Keyword	SN	STR	Serial Number
46	Length	0x18		
47	Serial Number		%STR_SPC	“00..00XXXX..XX”
71	VPD Keyword	V0	STR	Misc. Information
73	Length	0x10		
74	Data	PCIe Gen2 x8	STR_SPC	
90	VPD Keyword	RV	STR	
92	Length	0x1		
93	Data	0,92	%CS0	
94	Large Resource Type VPD-W Tag (0x11)	0x91		
95	Length [7:0] LSB	0x9E		
96	Length [15:8] MSB	0x00		
97	VPD Keyword	V1	STR	EFI Driver version
99	Length	0x6		
100	Data	N/A	STR_SPC	
106	VPD Keyword	YA	STR	Asset Tag
108	Length	0x20		
109	Data	N/A	STR_SPC	“N/A”
141	VPD Keyword	RW	STR	Remaining read/write area

Table 13 - VPD Layout for MHGH29-XTC (Continued)

Offset (Decimal)	Item	Value	Format	Description
143	Length	0x6F		
144	Data		STR_ZERO	Reserved (0x00)
255	Small Resource Type END Tag (0x11)	0x78		

Table 14 - VPD Layout for MHJH29-XSC

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length [7:0] LSB	0x9		
2	Length [15:8] MSB	0x0		
3	Data	Eagle QDR	STR	
12	Large Resource Type VPD-R Tag (0x10)	0x90		
13	Length [7:0] LSB	0x4F		
14	Length [15:8] MSB	0x00		
15	VPD Keyword	PN	STR	Add in Card Part Number
17	Length	0x15		
18	PN	PN	%STR_SPC	
39	VPD Keyword	EC	STR	Engineering Change Level of the card (rev)
41	Length	0x2		
42	Revision	A1	%STR	PCB revision
44	VPD Keyword	SN	STR	Serial Number
46	Length	0x18		
47	SerialNumber		%STR_SPC	“00..00XXXX..XX”
71	VPD Keyword	V0	STR	Misc. Information
73	Length	0x10		
74	Data	PCIe x8	STR_SPC	
90	VPD Keyword	RV	STR	
92	Length	0x1		
93	Data	0.92	%CS0	
94	Large Resource Type VPD-W Tag (0x11)	0x91		
95	Length [7:0] LSB	0x9E		
96	Length [15:8] MSB	0x00		
97	VPD Keyword	V1	STR	EFI Driver version
99	Length	0x6		

Table 14 - VPD Layout for MHJH29-XSC

100	Data	N/A	STR_SPC	
106	VPD Keyword	YA	STR	Asset Tag
108	Length	0x20		
109	Data	N/A	STR_SPC	“N/A”
141	VPD Keyword	RW	STR	Remaining read/write area
143	Length	0x6F		
144	Data		STR_ZERO	Reserved (0x00)
255	Small Resource Type END Tag (0x11)	0x78		

Table 15 - VPD Layout for MHJH29-XTC

Offset (Decimal)	Item	Value	Format	Description
0	Large Resource Type ID String Tag (0x02)	0x82		
1	Length [7:0] LSB	0x9		
2	Length [15:8] MSB	0x0		
3	Data	Eagle QDR	STR	
12	Large Resource Type VPD-R Tag (0x10)	0x90		
13	Length [7:0] LSB	0x4F		
14	Length [15:8] MSB	0x00		
15	VPD Keyword	PN	STR	Add in Card Part Number
17	Length	0x15		
18	PN	PN	%STR_SPC	
39	VPD Keyword	EC	STR	Engineering Change Level of the card (rev)
41	Length	0x2		
42	Revision	A1	%STR	PCB revision
44	VPD Keyword	SN	STR	Serial Number
46	Length	0x18		
47	SerialNumber		%STR_SPC	“00..00XXXX..XX”
71	VPD Keyword	V0	STR	Misc. Information
73	Length	0x10		
74	Data	PCIe x8	STR_SPC	
90	VPD Keyword	RV	STR	
92	Length	0x1		
93	Data	0,92	%CS0	
94	Large Resource Type VPD-W Tag (0x11)	0x91		

Table 15 - VPD Layout for MHJH29-XTC

95	Length [7:0] LSB	0x9E		
96	Length [15:8] MSB	0x00		
97	VPD Keyword	V1	STR	EFI Driver version
99	Length	0x6		
100	Data	N/A	STR_SPC	
106	VPD Keyword	YA	STR	Asset Tag
108	Length	0x20		
109	Data	N/A	STR_SPC	“N/A”
141	VPD Keyword	RW	STR	Remaining read/write area
143	Length	0x6F		
144	Data		STR_ZERO	Reserved (0x00)
255	Small Resource Type END Tag (0x11)	0x78		

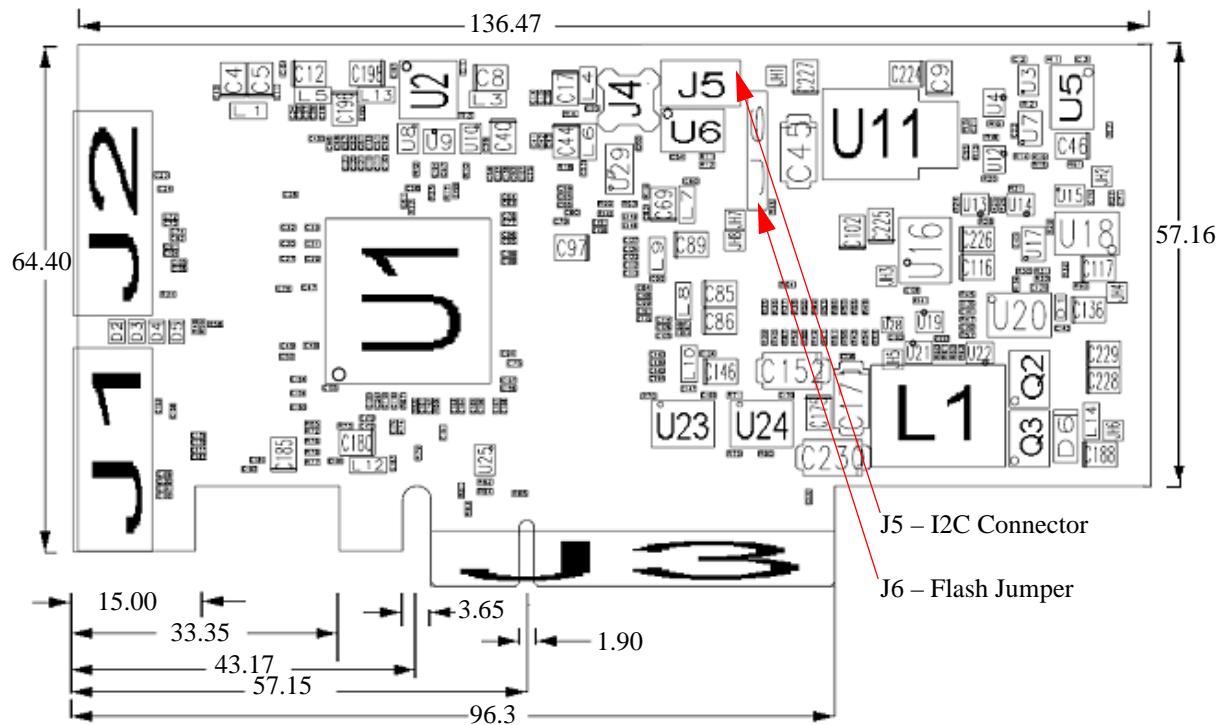
Appendix A: Specifications

A.1 Board Mechanical Drawing and Dimensions

All of the HCA cards covered in this *User's Manual* have the same mechanical drawing and share the same dimensions as depicted in Figure 6.

Note: All dimensions are in millimeters.

Figure 6: Schematic of the ConnectX IB HCA Card with CX4 Connectors



A.2 EMC Certification Statements

A.2.1 Table 16 lists the approved certification status per HCA card in different regions of the world.

Table 16 - HCA Cards Certification Status

HCA Card P/N	FCC Class (USA)	EN Class (Europe)	ICES Class (Canada)	VCCI (Japan)	C-Tick (Australia New Zealand)	MIC/BCC (Korea)	IEC/EN	cTUVus	CB
MHEH28-XSC	A	A	A	A	●	—	✓	✓	✓
MHEH28-XTC	A	A	A	A	●	—	✓	✓	✓
MHGH28-XSC	A	A	A	A	●	✓	✓	✓	✓
MHGH28-XTC	A	A	A	A	●	✓	✓	✓	✓
MHGH29-XSC	A	A	A	A	—	—	✓	✓	✓
MHGH29-XTC	A	A	A	A	●	✓	✓	✓	✓
MHJH29-XSC	A	A	A	A	—	—			
MHJH29-XTC	A	A	A	A	—				

A.2.2 FCC Statements (USA)

Class A Statements:

§ 15.21

Statement

Warning! Changes or modifications to this equipment not expressly approved by the party responsible for compliance (Mellanox Technologies) could void the user's authority to operate the equipment.

§15.105(a)

Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accor-

dance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

A.2.3 EN Statements (Europe)

EN55022 Class A Statement:

Warning

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

A.2.4 ICES Statements (Canada)

Class A Statement:

"This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada."

A.2.5 VCCI Statements (Japan)

Class A Statement:

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

(Translation - "This is a Class A product based on the standard of the Voluntary Control Council for Interference by Information Technology Equipment (VCCI). If this equipment is used in a domestic environment, radio interference may occur, in which case the user may be required to take corrective actions.")

A.3 MHEH28-XSC and MHEH28-XTC Specifications

Table 17 - Specifications for MHEH28-XSC/-XTC

Physical		Power and Environmental	
Size: Air Flow: 4X 10Gb/s Connector:	2.54in. x 5.37in. (64.4mm x 136.47mm) 200LFM @55°C InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Voltage: Typ. Power: Maximum Power: Temperature:	12V, 3.3V 11.01W 12.62W 0°C to 55°C
Protocol Support		Regulatory	
InfiniBand: QoS: RDMA Support: Data Rate: PCI Express	IBTA v1.2, Auto-Negotiation 10Gb/s, 2.5Gb/s 8 InfiniBand Virtual Lanes for each port Yes, All Ports SDR 2.0 SERDES @ 2.5 GT/s	EMC: Safety: Environmental: RoHS:	FCC 47 CFR part 15:2006, subpart B, class A ICES-003:2004 Issue 4, class A VCCI V-3/2007.04, class A EN 55022:1998+A1:2000+A2:2003 class A, EN 61000-3-2:2000+A2:2005, EN61000-3-3:1995+A2:2005, EN 55024:1998 + A1:2001+A2:2003 standards, harmonized under EMC Directive 2004/108/EC Article 6(2); AS/NZS 3548 IEC/EN 60950-1:2001 ETSI EN 300 019-2-2 IEC 60068-2- 64, 29, 32 RoHS-R5

A.4 MHGH28-XSC and MHGH28-XTC Specifications

Table 18 - Specifications for MHGH28-XSC/-XTC

Physical		Power and Environmental	
Size: Air Flow: 4X 20Gb/s Connector:	2.54in. x 5.37in. (64.4mm x 136.47mm) 200LFM @55°C InfiniBand (Copper, current rating: 0.5A max) with active media adapter support	Voltage: Typ. Power: Maximum Power: Temperature:	12V, 3.3V 11.05W 13.09W 0°C to 55°C
Protocol Support		Regulatory	

Table 18 - Specifications for MHGH28-XSC/-XTC

Physical		Power and Environmental	
<p>InfiniBand: QoS: RDMA Support: Data Rate: PCI Express</p> <p>IBTA v1.2, Auto-Negotiation¹ (20Gb/s, 5Gb/s) or (10Gb/s, 2.5Gb/s) 8 InfiniBand Virtual Lanes for each port Yes, All Ports DDR 2.0 SERDES @ 2.5 GT/s</p>		<p>EMC: •</p> <p>FCC 47 CFR part 15:2005, subpart B, class A ICES-003:2004 Issue 4, class A VCCI V-3/2005.04, class A MIC/ BCC class A EN 55022:1998+A1:2000+A2:2003 class A, EN 61000-3-2:2000+A2:2005, EN61000-3-3:1995+A1:2001, EN 55024:1998 + A1:2001+A2:2003 standards, harmonized under EMC Directive 89/336/EEC; AS/NZS 3548</p> <p>Safety:</p> <p>IEC/EN 60950-1:2001 ETSI EN 300 019-2-2 IEC 60068-2- 64, 29, 32</p> <p>Environmental:</p> <p>RoHS:</p> <p>RoHS-R5</p>	

1. The auto-negotiation protocol is proprietary of Mellanox Technologies and compliant with the *InfiniBand Architecture Specification, Release 1.2*.

A.5 MHGH29-XSC and MHGH29-XTC Specifications

Table 19 - Specifications for MHGH29-XSC/-XTC

Physical		Power and Environmental	
<p>Size: Air Flow: 4X 20Gb/s Connector:</p> <p>2.54in. x 5.37in. (64.4mm x 136.47mm) 200LFM @55°C InfiniBand (Copper, current rating: 0.5A max) with active media adapter support</p>		<p>Voltage: Typ. Power: Maximum Power: Temperature:</p> <p>12V, 3.3V 11.62W 13.68 W 0°C to 55°C</p>	
Protocol Support		Regulatory	

Table 19 - Specifications for MHGH29-XSC/-XTC

Physical		Power and Environmental	
<p>InfiniBand: QoS: RDMA Support: Data Rate: PCI Express</p> <p>IBTA v1.2, Auto-Negotiation¹ (20Gb/s, 5Gb/s) or (10Gb/s, 2.5Gb/s) 8 InfiniBand Virtual Lanes for each port Yes, All Ports DDR 2.0 SERDES @ 5.0 GT/s</p>		<p>EMC:</p> <ul style="list-style-type: none"> FCC 47 CFR part 15:2007, subpart B, class A ICES-003:2004 Issue 4, class A VCCI V-3/2007.04, class A AS/NZSCISPR 22: 2006, class A EN 55022:1998+A1:2000+A2:2003 class A EN 61000-3-2:2006 EN61000-3-3:1995+A1:2001+ A2:2005 EN 55024:1998 + A1:2001+A2:2003 standards, harmonized under EMC Directive 2004 /108/EC Article 6(2); AS/NZS 3548 (XTC only) MIC/ BCC class A (XTC only) <p>Safety:</p> <p>Environmental:</p> <p>RoHS:</p>	<p>•</p> <p>IEC/EN 60950-1:2001</p> <p>IEC 60068-2- 64, 29, 32</p> <p>RoHS-R5</p>

1. The auto-negotiation protocol is proprietary of Mellanox Technologies and compliant with the *InfiniBand Architecture Specification, Release 1.2*.

A.6 MHJH29-XSC and MHJH29-XTC Specifications

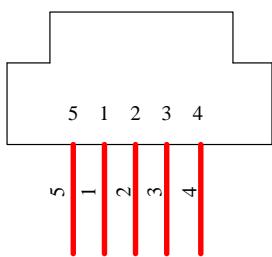
Table 20 - Specifications for MHJH29-XSC/-XTC

Physical		Power and Environmental	
Size: Air Flow: 4X 40Gb/s Connector:		Voltage: Typ. Power: Maximum Power: Temperature: 12V, 3.3V 12.23W 14.32W 0°C to 55°C	
Protocol Support		Regulatory	
InfiniBand: QoS: RDMA Support: Data Rate: PCI Express	IBTA v1.2, Auto-Negotiation ¹ (40Gb/s, 5Gb/s) or (20Gb/s, 5Gb/s) or (10Gb/s, 2.5Gb/s) 8 InfiniBand Virtual Lanes for each port Yes, All Ports QDR 2.0 SERDES @ 5.0 GT/s	EMC: Safety: Environmental: RoHS:	XTC only: ICES-003:2004 Issue 4, class A VCCI V-3/2007.04, class A AS/NZSCISPR 22: 2006, class A EN 55022:1998+A1:2000+A2:2003 class A EN 61000-3-2:2006 EN61000-3-3:1995+A1:2001+A2:2005 EN 55024:1998 + A1:2001+A2:2003 standards, harmonized under EMC Directive 2004 /108/EC Article 6(2); AS/NZS 3548 (XTC only) MIC/ BCC class A (XTC only)

1. The auto-negotiation protocol is proprietary of Mellanox Technologies and compliant with the *InfiniBand Architecture Specification, Release 1.2*.

Appendix B: Interface Connectors Pinout

B.1 I²C-Compatible Connector Pinout

Figure 7: I²C-Compatible Connector Plug and PinoutTable 21 - I²C-compatible Connector Pinout

Connector Pin Number	HCA Signal Name
1	SPSDA
2	SPSCL
3	GND
4	NC
5	NC

B.2 InfiniBand Connector Pinout

Figure 8: InfiniBand CX4 Connector Pinout

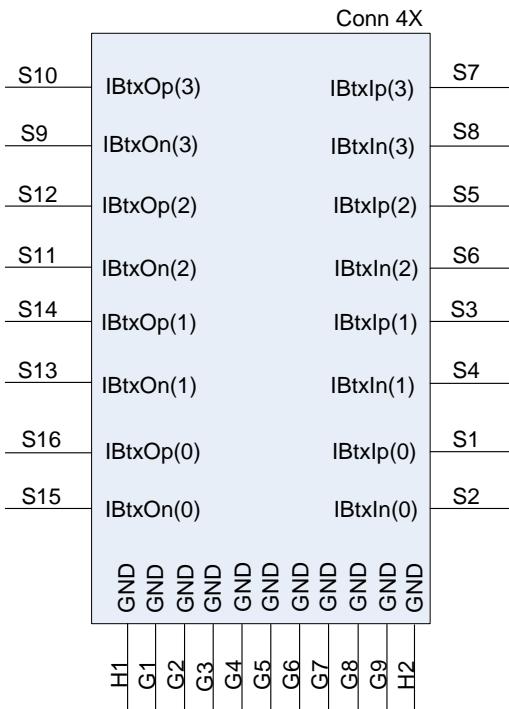


Table 22 - Connector Pin Name and Number to Signal Name Correspondence

Connector Pin Number	Connector Pin Name	IB Port A Signal Name
S1	IBtxIp(0)	Rx_A1
S2	IBtxIn(0)	Rx_A0
S3	IBtxIp(1)	Rx_A3
S4	IBtxIn(1)	Rx_A2
S5	IBtxIp(2)	Rx_A5
S6	IBtxIn(2)	Rx_A4
S7	IBtxIp(3)	Rx_A7
S8	IBtxIn(3)	Rx_A6
S9	IBtxOn(3)	Tx_A6
S10	IBtxOp(3)	Tx_A7
S11	IBtxOn(2)	Tx_A4
S12	IBtxOp(2)	Tx_A5
S13	IBtxOn(1)	Tx_A2
S14	IBtxOp(1)	Tx_A3
S15	IBtxOn(0)	Tx_A0
S16	IBtxOp(0)	Tx_A1
G1-G6, G9, H1-H2	Signal Ground	GND
G7 ¹	Sense-3.3V	SENSE_P1
G8	Vcc	MC_POWER_P1

1. The Sense-3.3V signal is used to enable the Vcc power supply pin (G8) used to provide power to the active media adapter.

B.3 PCI Express x8 Connector Pinout

These cards use a standard PCI Express x8 edge connector and the PCI Express x8 standard pinout according to the PCI Express 2.0 specification.

Appendix C: Replacing a Tall Bracket With a Short Bracket on HCA Cards

This appendix provides instructions on how to remove the tall bracket of a standard Mellanox Technologies HCA card and replace it with a short one. It includes the following sections:

- “Removing Tall Bracket”
- “Placing a Kapton® Polyimide Label”
- “Assembling Short Bracket”

Figure 10 shows the bracket-side view of an HCA card.

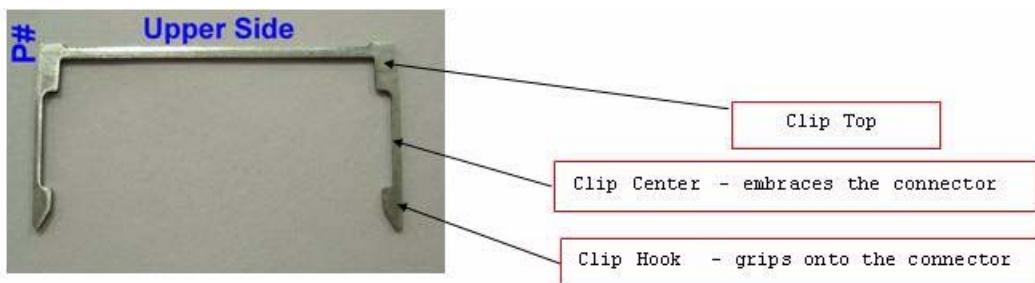
Figure 9: Tall Bracket of a Dual IB Port HCA Card



C.1 Removing Tall Bracket

Figure 10 shows a connector retention clip and the designated names of its sections.

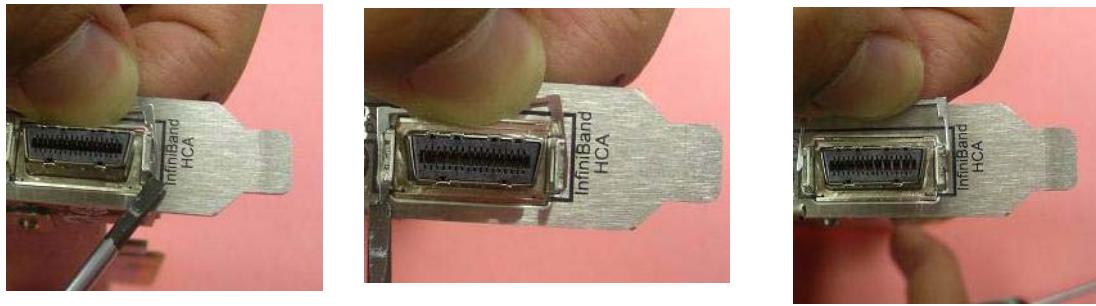
Figure 10: Connector Retention Clip



1Using a small flat head screwdriver, gently push up one hook of a connector's clip toward the connector's top side as shown in Figure 11 on page 36 (a).

2. Then push the other hook. With both hooks unlatched push the clip towards the connector's top side - see Figure 11 (b). Finally, pull the clip away from the bracket - see Figure 11 (c).

Figure 11: Extracting Connector Clip



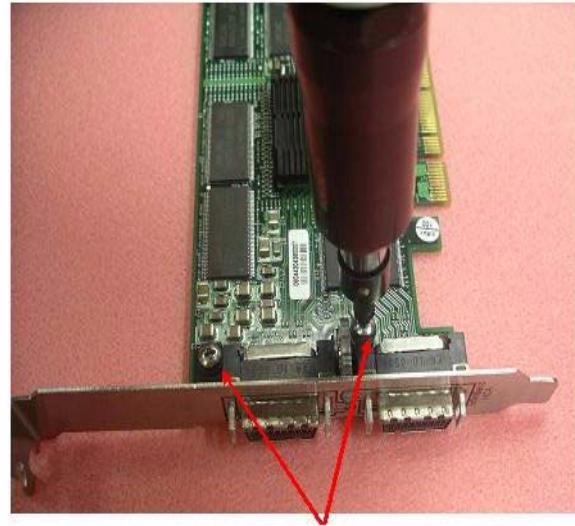
(a) Gently Push One Hook of Clip

(b) Gently Push Other Hook of Clip

(c) Pull Clip Away

3. Repeat the above actions for the second connector's clip.
4. Unscrew both screws from the card using a torque screwdriver as shown in Figure 13.

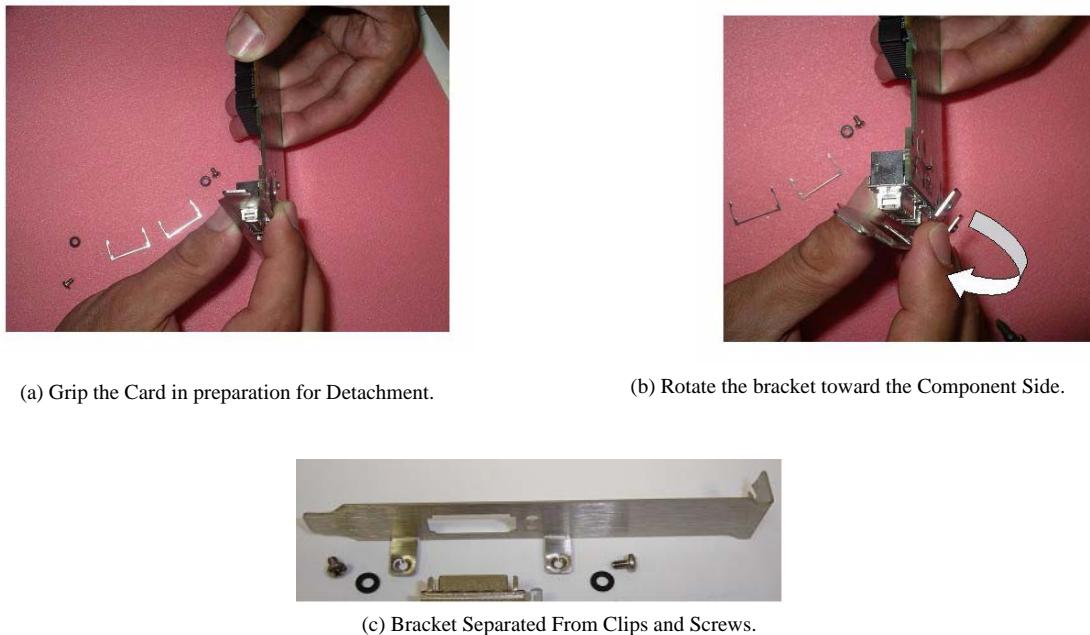
Figure 12: Bracket Screws



These two screws hold
on the bracket

5. Grip the bracket as shown in Figure 13, placing your thumb on the LED component.
6. In a rotating move toward the component side of the card, slide the bracket out of the connector (Figure 13 (b)).
7. Gently hold your thumb on the LED component.
8. At the same time extract the bracket as shown in Figure 13 b, (Make sure to protect the LED while extracting the bracket).

Figure 13: Rotate the Bracket to Detach it From the Card



(a) Grip the Card in preparation for Detachment.

(b) Rotate the bracket toward the Component Side.

(c) Bracket Separated From Clips and Screws.

C.2 Placing a Kapton® Polyimide Label

Prior to assembling the short bracket, you need to apply a Kapton® polyimide round label on the board's Print Side.

Note: Check to see if the label is already installed as this label may have been installed at the factory.

Note: The label can be provided by Mellanox Technologies (P/N: MEC000821).

The following steps are instructions for placing the polyimide label:

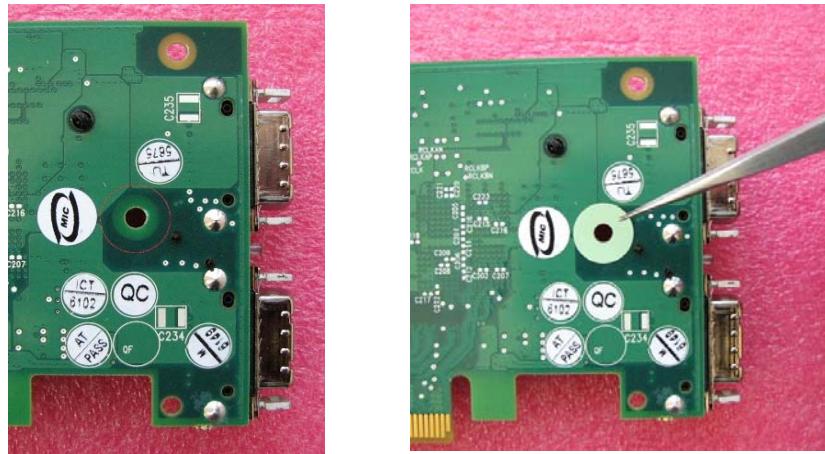
1. Make sure your working area is ESD protected.
2. Hold the label with light pincers. See Figure 14.

Figure 14: Hold Kapton Label With Pincers



3. Gently place the label as shown in Figure 15. Make sure to align the center hole of the label with the drilled hole in the board.

Figure 15: Place Label on Print Side With Label's and Card's Holes Aligned



4. After placing the label, complete the process by (gently) sweeping your thumb on the label to assure the label is well-attached onto the board. See Figure 16.

Figure 16: Ensure That Label is Well-attached



See also Figure 21, “Print Side View After Short Bracket Assembly With Kapton Label,” on page 40.

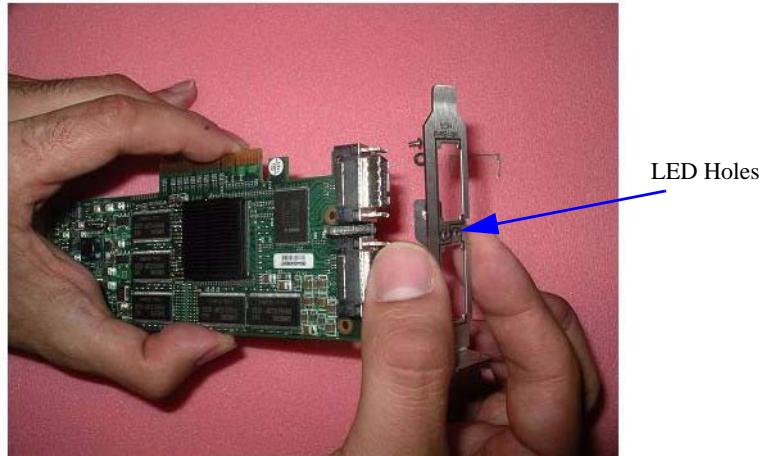
Now your card is ready for a short bracket assembly.

C.3 Assembling Short Bracket

The short bracket can now be assembled onto the HCA card.

1Gently place the bracket onto the card fitting the connectors through the bracket connector holes. The tab on the bracket should be pointing in the same direction as the PCI connector. Make sure the LEDs are aligned into their intended bracket holes.

Figure 17: Place Short Bracket onto Card



2. Insert a screw along with a washer into each of the two holes on the card, intended for holding the bracket.
3. Use a torque screwdriver to apply up to 2 lbs-in torque on each screw.

Figure 18: Attach Bracket onto Card using Screws



4. Gently push the clip onto the connector. Make sure to slide both clip hooks (sides) around the connector evenly as shown in Figure 19.

Figure 19: Sliding Connector Clip Evenly



5. Use a small flat head screwdriver to gently slide the clip hooks towards the connector's base side as shown in Figure 19.
6. Repeat this step for the second clip. See Figure 20 for the assembled short bracket (side) view, and Figure 21 for the Print Side view showing the Kapton label.

Figure 20: Assembled Short Bracket



Figure 21: Print Side View After Short Bracket Assembly With Kapton Label



Appendix D: Avertissements de sécurité d'installation

1. Instructions d'installation



Lisez toutes les instructions d'installation avant de brancher le matériel à la source d'alimentation électrique.

2. Température excessive



Ce matériel ne doit pas fonctionner dans une zone avec une température ambiante dépassant le maximum recommandé de 55°C (131°F). En outre, pour garantir un bon écoulement de l'air, laissez au moins 8 cm (3 pouces) d'espace libre autour des ouvertures de ventilation.

3. Orages – dangers électriques



Pendant un orage, il ne faut pas utiliser le matériel et il ne faut pas brancher ou débrancher les câbles.

4. Branchement/débranchement des câbles InfiniBand en cuivre



Les câbles InfiniBand en cuivre sont lourds et ne sont pas flexibles, il faut donc faire très attention en les branchant et en les débranchant des connecteurs. Consultez le fabricant des câbles pour connaître les mises en garde et les instructions spéciales.

5. Installation du matériel



Ce matériel ne doit être installé, remplacé ou entretenu que par du personnel formé et qualifié.

6. Elimination du matériel



L'élimination de ce matériel doit s'effectuer dans le respect de toutes les législations et réglementations nationales en vigueur.

7. .Codes électriques locaux et nationaux

Ce matériel doit être installé dans le respect des codes électriques locaux et nationaux.

